Natural Selection and Adaptation

The only permanent thing is change.

> Change is not the exception to the rule, it is the rule. Throughout nature, the struggle to survive is an effort to cope with change: The climate changes, prey animals become harder to see, predators become faster, disease strike without warning, population increases put added stresses on the availability of food, water, habitable spaces and other resources (page 3).

How do species deal with change in the environment in order to survive? The process described in chapter 1 is natural selection.

Natural Selection and Adaptation

Within a species, there can be quite a bit of variation within its members.

- Individual members that have traits or variations that facilitate survival are more likely to survive, and reproduce. Their following generations are more likely to display these traits.
- Individual members that have traits or variations that hinder survival are more likely to die and NOT reproduce. Their following generations are not likely to survive or exist.

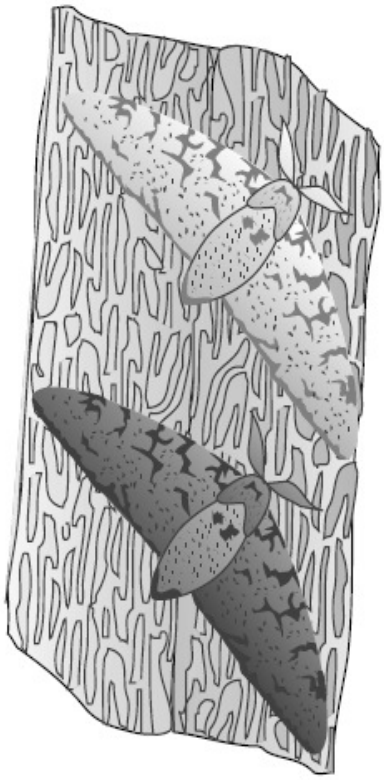
Traits that facilitate survival are more likely to allow that person (or group of people) to survive, live longer, reproduce and grow in numbers. Traits that don't facilitate survival are less likely to allow that person or group to survive, live longer, reproduce and grow in numbers.

This process of natural selection may take several generations or more for traits to be selected for survival. For those with short time to reproduce, like bacteria, this can be a short time period. For those with a longer time to reproduce, like humans, this may take more time occur.

Natural Selection and Adaptation

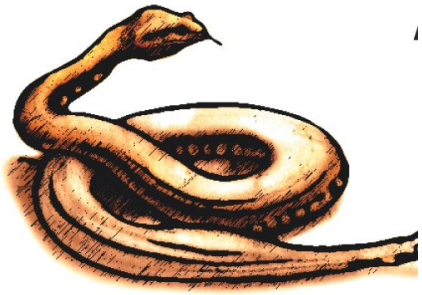
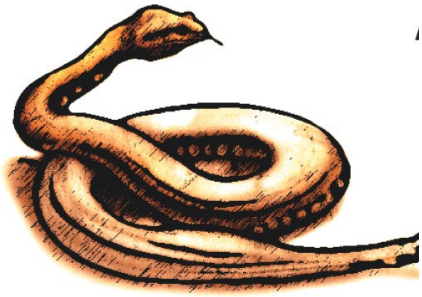
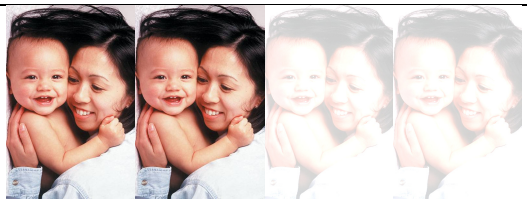
The gray peppered moth (page 9) has variations in color. They are mostly gray with some variations that are darker.

In environments where lichen covered trees are similar to the color of the moth (left picture), they are more likely to survive and reproduce. The rarer black mutation shows up easier on trees and is more likely to get eaten by birds.



However, in forests near industrial sites where pollution killed the lichen and darkened the bark of the trees, the darker moths had an advantage and made them more difficult to be found and eaten. Therefore, they were more likely to survive and reproduce.

Natural Selection and Adaptation

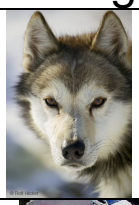
Afraid of Snakes	Not afraid of Snakes
	
More likely to avoid dangerous snakes	Less likely to avoid dangerous snakes
Live longer, have larger families	Live shorter lives, have smaller families
 Generation A	 Generation a
 Generation A+1	 Generation a+1
 Generation A+2	 Generation a+2

Natural Selection and Phobias

Phobias—An anxiety disorder that is characterized by marked, persistent and excessive fear and avoidance of specific objects, activities or situations. The fear response is out of proportion to the stimulus and the fear and avoidance must significantly interfere with daily life.

About 11% of people in the United States will develop a specific phobia in their lifetime. Generally, phobics realize their fears are irrational, but feel compelled to avoid the feared situation or objects.

Specific phobias fall into five categories:

(1) animals (dogs, cats, rats, snakes, spiders)	  
(2) natural environments (heights, darkness, water, storms)	 
(3) situations (bridges, elevators, tunnels, enclosed spaces)	 
(4) blood injections and injury	
(5) other phobias including illness and death.	

Evolved Behavior

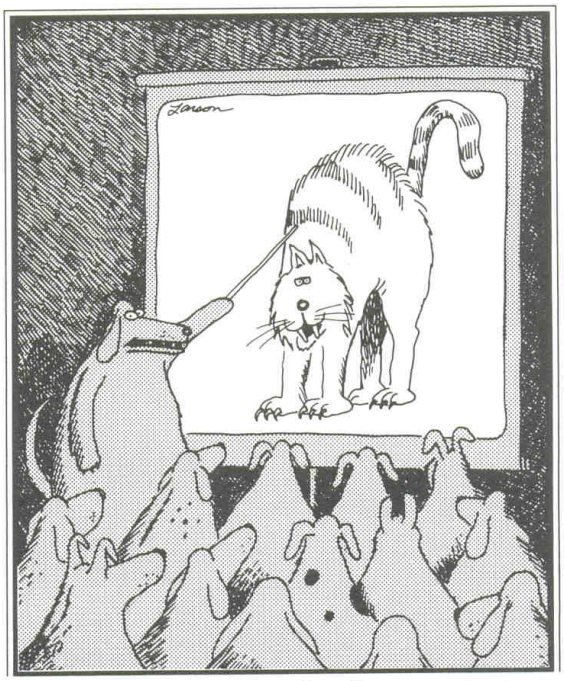
- Reflexes
- Modal Action patterns (MAP) or fixed action patterns
- General Behavior Traits

Modal Action Patterns (MAP) / Fixed Action Patterns

A modal action pattern (fixed action patterns) is a series of interrelated acts found in all of our nearly all members of a species (page 13). It is believed that modal action patterns (MAP) have a strong genetic basis and involve a series of behaviors such as

- a cat hissing and arching it's back and hisses when cornered by a dog.
- an opossum playing dead when encountering what it thinks is a predator. Some of the opossum's predators will only eat animals they have killed themselves, cover a dead animal and return later.
- Salmon migrating upstream to spawn.

The cat hissing, the opossum playing dead are automatic series of behaviors that are generally adaptive.



"Now, in this slide we can see how the cornered cat has seemed to suddenly grow bigger. ... Trickery! Trickery! Trickery!"

Modal Action Patterns (MAP) / Fixed Action Patterns

Modal action patterns are generally a set of behaviors that are performed automatically under a variety of conditions that are generally unchangeable.

Scientists believed that there were human instincts such as self-preservation, sex instinct, social instinct, and maternal instinct.

However, how we approach the behaviors involved with these so-called instincts are different across situations, and cultures.

Limits of Natural Selection—it is slow

The main problem with natural selection with coping with a changing environment is that it is slow (page 19). It does not help with individuals having to cope with new predators introduced into the environment, changing temperatures, etc. It works across generations to help the species survive.

The guppies mentioned earlier adapted to their new environment but took between 13 and 26 generations (8 years). 13 to 26 generations in humans would take more than 200 years. This assumes women would have children in their teens. (page 19)

Limits of Natural Selection—it helps the next generation

The changes with natural selection do not help the current generation. If the changes in the environment are stable, changes in the next generation of the species may be beneficial. If the changes in the environment are not stable, changes in the next generation may not be beneficial.

- In the wild, it is adaptive for rabbits to dodge back and forth when pursued by foxes, coyotes, or bobcats. However, this behavior is not that effective when being pursuit by a car on a highway (page 20).
- In a world where salt, sugar and food were scarce and hard to find, people who were biologically predisposed for these foods were more likely to survive. However, when food is plentiful, these biological predispositions can lead to high blood pressure and obesity (page 20).

With the limits of natural selection in a rapidly changing environment, natural selection will not help us survive. The mechanism in which the person can adapt to rapid change is learning.

Learning

One definition of learning is that it is a change in behavior due to experience. Changes in behavior due to drugs, injury, aging or disease do not qualify as learning (page 25).

We will focus on learning environments for change since that is what we can affect.

What are some major problems that we have to deal with in our lives?

How can the psychology of learning address these problems? We may not have the answers in week 1, but this is something for you to think about in throughout the 10 weeks.

Nature or Nurture?

Are we a product of our biology or our environment? When phrased like this, it tends to focus our attention on a choice between the two options (see the logical fallacy false dilemma or black and white fallacy)

We are generally considered a product of both and often expressed as nature via nurture. Our biological predispositions will manifest themselves differently in different environments (see page 28).

Major Aspects of Learning

- Research Methods
- Pavlovian Conditioning (Classical Conditioning)
- Operant Conditioning
    - Reinforcement
    - Schedules of Reinforcement
    - Punishments
- Observational Learning
- Generalization, Discrimination, extinction